Risk Factors and Early Survival Rate of Biomet 3i Dental Implants. A Retrospective Study

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Abstract

Introdouction:

Although highly desirable outcomes and long-term survival of dental implant treatments are well documented, implant failures still occur due to various reasons. Several risk factors may impair implant survival including implant dimensions (length, diameter, and implant design), procedures, local bone density at the implant site, and patient-related risk factors such as age, smoking, and history of periodontal disease, diabetes mellitus, and osteoporosis. Implant failures are classified as early (failure to establish osseointegration) and late (failure to maintain osseointegration) failures. This retrospective study evaluated the survival rates and the associated risk factors of dental implants.

Materials and methods:

A retrospective cohort of 969 Biomet 3i dental implants from two private practices between 2008 and 2011 were evaluated. The implants were evaluated based on the following parameters: age and sex, smoking, and diameter and surface characteristics of implants. All the dental implants were from a single manufacturer, Biomet 3i (West Palm Beach, FL, USA) with two surface modifications including dual acid-etched with calcium phosphate nanoparticles (Nano-Tite) or acid-etched (OSSEOTITE).

Results:

Overall success and failure rates of Biomet 3i implants were 97.11% (n = 941) and 2.88% (n = 28), respectively. Among the risk factors, smoking significantly correlated with the increased failure rate of implants (p = 0.041). No significant relationship was observed between other risk factors and the survival rate of dental implants.

Conclusion:

The overall survival rate of Biomet 3i dental implants was considerably high. Smoking is a major risk factor that is positively correlated to the failure rate of dental implants. More prospective clinical trials are required to evaluate the exact effect of other risk factors on the implants.

Key words: •*Osseointegration* •*Dental Implants* •*Risk Factors*

Introduction

Dental implants are generally considered as an effective treatment modality for the replacement of missing teeth.[1] Although highly desirable outcomes and the long-term survival of dental implant treatments are well documented by numerous studies, implant failures still occur due to various reasons.[2] In this context, risk factor assessment of dental implants has become a topic of frequent discussion and research.

It has been suggested that several risk factors may impair the implant survival rate, including the implant position (anterior vs. posterior region and maxilla vs. mandible), implant dimensions (length, diameter, and implant design), procedures, local bone density at the implant site, and patient-related risk factors such as age, smoking, history of periodontal disease, diabetes mellitus, and osteoporosis.[3,4,5] Implant failures are classified as early (failure to establish osseointegration) and late (failure to maintain osseointegration) failures. Early implant failures are those that are removed before prosthetic restoration, while those occurring after prosthetic rehabilitation are the late failures.[6] Esposito found that surgical trauma and bone quality and quantity were the most important etiological factors involved in the early implant failures.[7] The influence of systemic factors in the osseointegration process is poorly documented.[8] Considering that implant failure is a major complication for both the patient and clinician, evaluating the potential risk factors of dental implants and therefore designing a comprehensive treatment plan are definitely important to prevent the future complications. Therefore, the aim of this retrospective study was to evaluate the survival rates and the associated risk factors of dental implants..

Materials and Methods

In this retrospective Cohort study 969 Biomet 3i dental implants from two private practices between 2008 and 2011 were evaluated. All patients provided written informed consent for the scientific use of their data. All the dental implants were from a single manufacturer, Biomet 3i (West Palm Beach, FL, USA) with two surface modifications including dual acid-etched with calcium phosphate nanoparticles (NanoTite) or acid-etched (OSSEOTITE) (Figure 1).Before in-

sertion of the implant, clinical and radiographic examination of the patients was performed by a single clinician. After confirming the ideal prosthetic and anatomical condition of the surgical site, the implants were replaced in the edentulous area.

Figure 1- Biomet 3i dental implants

The exclusion criteria were uncontrolled systemic disease, uncontrolled diabetes, short implants (<10 mm), and delayed or simultaneous guided bone regeneration. The selected implants were evaluated based on the following parameters: age and sex, smoking, and the diameter and surface characteristics of the implants. Finally, the early survival rate of the implants was analyzed. Data were analyzed by a statistical software package (SPSS 22; SPSS, Chicago, IL) using descriptive statistics and Chi square test and Fisher's exact test. P value of 0.05 was considered to be statistically significant.

Results

A total of 969 dental implants were replaced in the edentulous area of the patients at two private dental practice clinics from 2008 to 2011. Overall success and failure rates of the implants were 97.11% (n = 941) and 2.88% (n = 28), respectively. Regarding the risk factors, it was ob-

served that smoking significantly correlated to the increased failure rate of implants ($p < 0.05$, $p = 0.041$; Figure 2). No significant relationship was observed between other risk factors and survival rate of the dental implants (Table 1).

Table 1. prevalence of implant survival rate according to Surface characteristic, diameter and sex

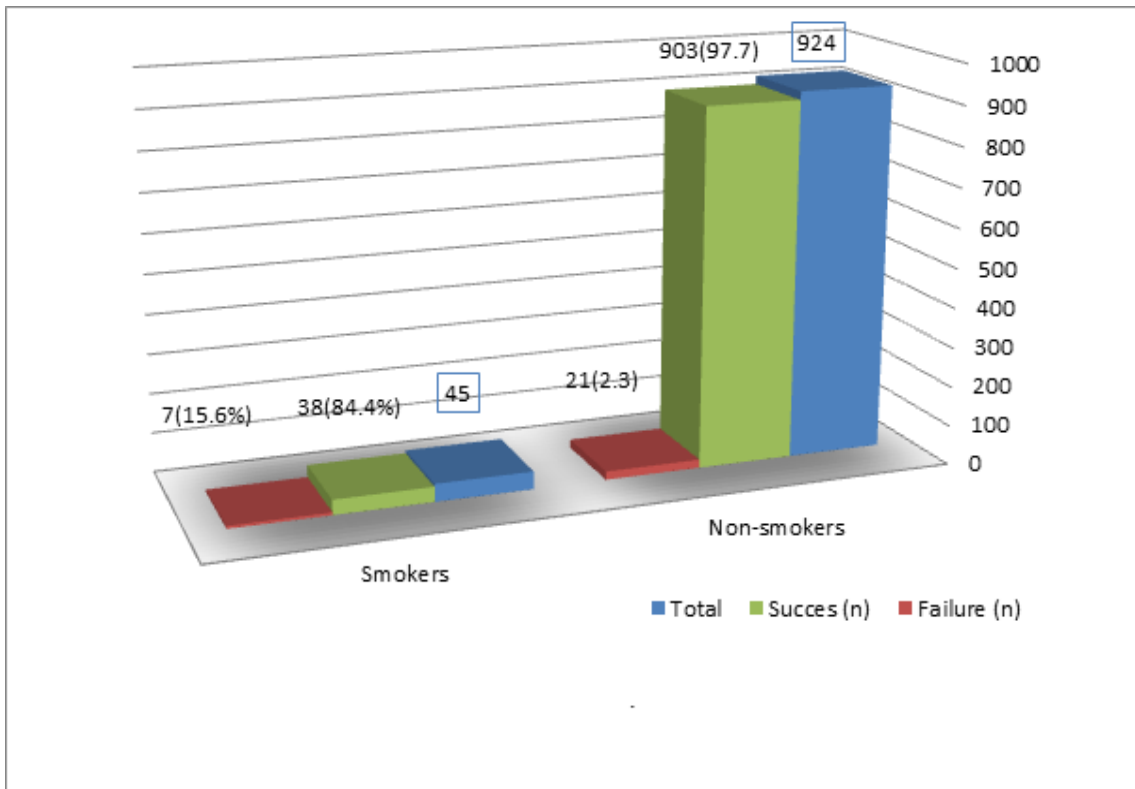|	variables	Survival rate	Failure rate	total	P-value
Surface characteristic	Fullosseotite	523(96.85%)	17(3.14%)	540(100%)	
	Nanotite	418(97.43%)	11(2.56%)	429(100%)	0.195
	total	941	28	969	
diameter	3.25 mm	196(97.5%)	5(2.5%)	201	
	4 mm	545(97.67%)	13(2.32)	558	0.142
	>5 mm	200(95.23%)	10(4.76%)	210	
		941	28	969	
sex	male	520(96.3%)	20(3.7%)	540	
	female	421(98.1%)	8(1.9%)	437	0.1
		941	28	969	

Figure 2.prevalence of implant failure rate in smokers and nonsmokers.significat failure rate was found among smokers.(Fisher Exact test, p<0.05)

Discussion

An earlier study had reported an overall 95% survival rate of dental implants.[1] This treatment represents a highly predictable and widespread therapy for rehabilitation of the incomplete dentition. However, it is important that studies be conducted for evaluating the risk factors of dental implants. Therefore, this study evaluated the survival rates of Biomet 3i dental implants and the associated risk factors of early implant

failure.The Academy for Oral Implantology in Vienna evaluated the risk factors of more than 13,000 implants among 4000 patients.

It was a retrospective study with 8 years of follow-up period and the results showed that smoking correlated to a 3-fold increased rate of implant failure. The authors of the study stated that smoking is a critical risk factor of implant failure and decreased the survival rate of implants by 76.5%.[9]

Chung showed that daily smoking correlated with a high failure rate of dental implants.[10] Koldsland et al. reported that only one failure occurred in the group of nonsmoking patients and the remaining failures were observed in the smoking group.[4] Baiq [11] stated that implant failure rate among smokers is 2-fold higher than that in nonsmokers.Gorman [12] found that smoking was not associated with the significant higher rate of implant failure and hence suggested for more prospective studies in this area.

A meta-analysis by Albrektsson in 2015 showed that among 19,836 implants replaced in the smokers and 60,464 replaced in the nonsmokers, failure rates were observed in 1259 (6.35%) and 1923 (3.18%) smokers and nonsmokers, respectively, which was statistically significant.[13]

However, several studies have contradicted the negative effect of smoking on dental implants. [13,14] Hence, the exact effect of smoking on dental implant failure is still poorly understood. Some researchers stated that smoking impaired wound healing process and osseointegration. [15,16] Others demonstrated that the load-bearing capacity of the bone against occlusal forces was decreased in smokers.[17,18] Another study suggested that smokers treated with implants had an increased risk of postoperative complications, such as infection and peri-implantitis.[19]Thus, it seems that multiple mechanisms are associated with the increased rate of implant failures in smokers.[20,21] It is well documented that patients commence a smoking cessation protocol at least 1 week before and at least 2 months after the dental implant surgery to assure dental implant osseointegration.[22]

Our study revealed that the implant diameter was not related to early implant failure. Similarly, Sverzut noted that implant diameter is not a critical risk factor of early implant failure.[23] Other studies also showed that the failure rate of

narrow implants (3–3.5 mm diameter) is not different from that of standard implants, although marginal bone loss is considerably higher in the narrow implants.[24] However, Ortega observed that narrow implant (<3.3 mm) failure rate is significantly higher than that of standard implants (>3.3 mm).[25] In addition, several studies in the literature have reported that the survival rates of standard and smaller diameter implants are between 95% and 100%, and no study had reported survival rates below 89%.[26]

It has to be mentioned that short implant (<10 mm length) was not included in the present study. Some authors believe that short and narrow implants (<10 mm length, <3.3 mm diameter) are related to high failure rates.[27] For this reason, we excluded short implants from the current study, which could have probably resulted in the higher survival rate of implants.

Both the two implant surface characteristics were correlated with the high implant survival rate, with no significant differences between them. Surface modification of an implant has been widely applied in order to obtain a highly active surface and the optimal osseointegration. From a biological standpoint, studies have shown that dual acid-etched surface modification with impregnation of calcium phosphate nanoparticles may relatively improve faster apposition of new bone at the implant surface and have suggested utilizing this modification process in early loading protocols. However, no additional clinical effect of this surface was observed compared with conventional acid-etched surface.[28,29]

Conclusion

The overall survival rate of Biomet 3i dental implants was considerably high in this study. Smoking is a major risk factor that positively affects the failure rate of dental implants. More prospective clinical trials are needed to evaluate the exact effect of other risk factors on the implants.

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